Tentative Recommendations

In the first phase of research, this project has focused on the 'hard' parts of the interface — switches, indicators, and the terms and symbols around them[1]. We are gathering data on all aspects (that is, all topics identified in the plan) and will draw conclusions about the other parts later on.

There are several reasons for this focus: The hard parts of the interface are what we first encounter with a product (and are sometimes all of the interface); they have more limitations than other parts of the interface; they are more universal (they apply to nearly all products whereas other aspects apply only to subsets); and it seems easier to adapt the other parts of the controls to the hard portions than vice-versa. We do not expect that our continuing research will change these initial conclusions. These conclusions emerged from a combination of our review of user interface literature in combination with our examination of the operation and design of current products. We expect that future forms of this discussion will distinguish between core parts of the voluntary standard and design comments and recommendations that accompany the core.

It is good interface design practice to not change designs unless there is a compelling reason to do so. Current product design has been informed by some design insights and market-driven evolution, so that some deference must be paid to the status quo. Thus, when there is not a problem with it, standardizing that practice which is most common is the default choice. Other key priorities are simplicity and internal consistency.

Highlights

We recommend to:

- To the extent possible, use only three power states: On, Off, and Sleep.
- Use the word "Power" for terminology about power.
- Drop the ⏻ symbol from use and use the ⏼ symbol for on/off (power) buttons and power indicators. This would require changing the ISO/IEC standard but is most consistent with actual usage on current products.
- Adopt the "green/amber/off" color indications for power indicators. This also is the design most in line with current usage. We suspect that some current standards incorporate this usage; we have yet to identify them, but will continue to seek out any such current standards (we have found references to older standards that use these color meanings). Red should be reserved for warnings, alarms, or errors.
- Use the 'sleep' metaphor for entering, being in, and coming out of low-power states; use the moon symbol for sleep.

Further details are below, both about the recommendations and the rationale for them. The only active step we (LBNL) propose to take regarding these recommendations is to contact the relevant standards committees regarding the symbol usage, to notify them of our stance and initiate discussion. As standards organizations are notoriously slow to act, alerting them at the earliest possible stage seems advantageous, even though we don't have a specific final recommendation.

[1] One of the literature sources we reviewed (Cushman/Rosenberg) uses the phrase "hard control panel" to refer to "control panels with conventional controls and displays". This is in contrast to display-based controls that mimic hard controls or software interfaces.

At the current stage, we do not seek the PAC's agreement or disagreement with these, but rather seek comment on them, and a sense about how quickly we may be able to finalize/formalize this part of the project.

General Observations about Hard Interface Elements

There is considerable diversity of the arrangements of buttons/switches, indicators, and labels on current devices, both the power/sleep elements themselves, and their relation to other controls and indicators. This is a combination of the diverse needs of the devices, reasonable aesthetic and design choices, and variation without any apparent purpose or value. We also found devices without switches, without indicators, without labels, and one without any of these.

Three Basic States[2]

Most devices currently have either two basic power states (**on** and **off**) or three (**on**, off, and a **low-power** mode). We recommend that devices be limited to these three basic states, and that any additional states be variants of one of the basic states rather than a fourth state.

For example, rather than be a separate mode, "hibernate" can be a form of sleep, or a form of off. Also, multiple low-power modes can be all by types of a basic "sleep" mode. The purpose is to have indicator colors, capability, switch operation, and overall behavior consistent within each basic state.

The Term "Power"

For terminology about power controls, we recommend wide use of the term "power" such as "power button" (or power switch), "power indicator", a "power" control panel, etc. The word need not be used on the hard interface itself. A standard translation could be found for each language, though it may be worth considering making it an international standard word in the way that "STOP" has become.

Power Symbols

The most common and prominent power control is an on/off switch with a power indicator nearby. The most common labeling of this at present is the ⏻ symbol. It seems (though we have not quantified the effect) that there is a shift away from the ⏼ symbol, which—according to the ISO/IEC definitions—is the correct symbol to use in these cases. We speculate that designers find the ⏻ symbol more visually appealing[3], and from our anecdotal experience, find that few people differentiate between the two symbols at all. If people don't or won't differentiate between ⏻ and ⏼, then it seems unadvisable to maintain both, regardless of their meaning.

The confusion is compounded by two further facts. The symbols are often used interchangeably with respect to their meaning, particularly with both being used for on/off switches. Secondly, the way they are printed often blurs the distinction, with the vertical bar on ⏻ sometimes lowered, the one on ⏼ lengthened, and the circle on ⏻ nearly closed.

[2] We use the words "state" and "mode" interchangeably and assume no difference in their meaning.
[3] For example, the Exelon corporation, whose identity was recently created out of an energy utility merger, chose the "Standby" symbol for its corporate logo. A representative of their public relations department said that it was chosen because it means "Power On".. http://www.exeloncorp.com/ In addition, an office equipment product designer told us it was chosen for an on/off symbol because that is what was on the equipment in their office.

Having two such similar symbols with different meanings seems contrary to good design practice. We do not recommend making any change to the "on" | and "off" ○ symbols, but believe that these are best use as a pair on rocker (and similar) switches (rather than in isolation or in combination with other symbols). The international standards also have an on-off symbol for "momentary on" buttons (a circle with a T in it). We have not observed this in use on office equipment or consumer electronics and would recommend against its use on them. However, it may have good uses in other areas (e.g. heavy machinery) and so an appropriate part of the international standards.

Indicators

The green/amber[4]/off indicator color usage has no serious competitor in popularity, though there are many alternate indications that do exist. The only obvious drawback to it seems to be that people with red/green colorblindness may not notice an additional red indication of an error[5]. This set of colors has the advantage of clear consistency with the colors used in traffic lights[6], with green meaning 'go'/continue, and yellow indicating caution or slowness.

We strongly discourage the use of blinking indications for any long-term power state; it can be annoying and draws unwarranted attention. Some current devices use blinking for a transition state, e.g. "warming up" (or "waking up") or "cooling down" (as on a projector), but these are of limited time. Some devices may choose to use blinking of the power indicator for non-power meaning, such as an error mode, message waiting, etc. This does not seem to present a problem, though red is preferable for errors. It may be desirable to have a single or double blink when a transition occurs, much like a visual 'beep' to confirm that the state change has registered (essentially a minimum-duration transition).

A possible exception to the blinking standard might be made for battery-powered products. Some of these presently conserve power by illuminating an LED only during brief blinks during sleep modes. If this is used, at least the amber color can indicate sleep.

For transitions, optional audio indications should probably also have some standard. Devices with motors that spin up and down with their power state provide a model. These range from jet planes to the hard disk drives on PCs. These suggest using a rising tone for a turn-on or wake-up event, and a falling tone for a turn-off or going-to-sleep event. The interval the tone covers could be much larger for the on/off transitions than for the sleep transitions to indicate the magnitude of the change. Everything else about the audio signal could be left to the discretion of the designer, such as time duration, tone intervals, tambre, pitch, etc. Current systems which have a constant tone on boot-up are perhaps connoting an orchestra tuning up indicating a 'ready' state, but this doesn't seem to have good analogues for sleep transitions or turn-off.

Sleep Metaphor and Symbol

For devices in a reduced-capability, low-power state, the 'sleep' metaphor is the most common and clear metaphor used, and is often referred to in manuals even in cases in which other terms (e.g. standby or suspend) are used in the user interface.

For the competitors to sleep, the idea of 'suspending' activity may conjure up a clear idea, but is problematic as some devices (e.g. a printer or copier) have a mode of activity or inactivity that is separate from whether the device is globally awake or asleep. There is also no

[4] The actual colors used on products and terms used in manuals varies from product to product; we don't ascribe any significance to using "yellow", "amber", or even "orange" and use the terms interchangeably.
[5] One ergonomic reference suggested possible yellow/green confusion among people with red/green colorblindness.
[6] Traffic signals also use position in addition to color to indicate their state. This could be adopted on office equipment, with the green indication below a yellow one (red would not apply).

obvious visual analog to 'suspend', nor is the verbal extensions appealing ("going into suspend") or obvious (e.g. "resuming" from suspend). The term 'standby' does not seem to reside within a single obvious metaphor, and is problematic due to its many diverse meanings.

The sleep metaphor could be carried too far, such as to imply that a device that is off is 'dead'. This does not seem to be a problem with current devices that use the sleep metaphor.

The metaphor manifests itself as: the term "sleep" which can be used on graphic displays to show a low-power mode, and in control panels; the 'moon' symbol for buttons that manually put the device into or out of the sleep mode (or, rarely, for a sleep indicator separate from the power indicator); and the phrases and ideas of 'waking up' and 'going to sleep'.

The moon symbol —  — is the most common graphic representation of sleep (though multiple "Zs" (ZZZZZ) are sometimes used). There is no similar symbol on products that it could easily be confused with, and meets the criteria of simplicity for symbol design. A near-term task is to determine if the use of it is problematic for people of Islamic faith.

Implications

The recommended usage is related in the "Generic Product Instructions". These recommendations do not require any more switches or indicators than present practice contains. Aside from requiring adoption by manufacturers, these also would require changes to the international standards for the Standby and On/Off symbols.

Outstanding Issues

The term 'hibernate' is potentially problematic, since the word suggests a form of deep sleep[7]. If, as we recommend, it be considered a form of 'off', then a different term may be needed. There also may need to be a corresponding symbol. We have no suggestions for either at this time. For some devices (e.g. current PDAs), there is no 'off' mode different from a hibernate behavior.

Some other terminology needs further consideration, such as whether "mode", "state" or some other term should be in user documentation. "Idle Timer" and "Schedule" may also not be the best words to use.

Consideration of "Power" as an international word is merited.

Standard Terms

Terms that seem clearly useful to use as standards include: Power, Sleep, On, Off, Power Button, Sleep Button, Power Indicator, Sleep Indicator, and Power Control Panel.

[7] "Coma" has been suggested as an alternative term for "hibernate".